

U.S. Pat. No. 4,462,134 to Wang discloses blackboards eraser (1984)
U.S. Pat. No. 4,742,594 to Chen discloses blackboards eraser (1988)
U.S. Pat. No. 4,941,225 to Liao discloses automatic chalk-powder collecting device for blackboards eraser (1990)
U.S. Pat. No. 5,075,915 to Rodriguez discloses eraser cleaner (1991)
U.S. Pat. No. 5,099,541 to Tressler discloses blackboards eraser apparatus (1992).
U.S. Pat. No. 5,216,776 to Dennison discloses automatic blackboards eraser apparatus (1993)
U.S. Pat. No. 5,455,976 to Kim discloses apparatus for automatically brushing chalk powder off from blackboardss eraser (1995)
U.S. Pat. No. D,366,670 to Huh discloses blackboards eraser (1996)
U.S. Pat. No. 5,530,984 to Walker discloses quick wipe eraser for chalkboards (1996)

In this respect, the present invention for a Dustless Eraser for Blackboards is substantially different from the designs of the prior arts.

The overall advantage for newly invented Dustless Eraser for Blackboards is as follows:

- 1) The eraser case (10) enables a connection to a vacuum cleaner (80) via the hose rotator (10) design. This is the best way to remove chalk powder effectively.
- 2) The brusher (20) on the base of the eraser case (10) has a large surface area in contact with the eraser belt fabric (30). As long as the eraser is moving in an up or down direction, the chalk powder attached to the eraser belt fabric (30) surface will be shifted to the base position by the rollers and chalk powder will be quickly wiped off by the brusher (20).
- 3) The outline of the eraser belt fabric (30) is fully supported by a bracket (60). During erasing, the eraser belt fabric is in full contact with the blackboards. This will prevent the problems that arise from partial contact with the blackboard's surface.
- 4) The movement of the eraser belt fabric (30) has been contained inside the bracket (60) when the eraser belt fabric (30) shifts laterally. This design keeps the eraser belt fabric in the proper track of the roller.

Therefore, it can be appreciated that a new Dustless Eraser for Blackboards can erase chalk from blackboards without producing any airborne chalk powder.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

1. Map description

Map No. 1: Illustrates 1st design version disassembled layout in 3D

Map No. 2: Illustrates assembled with no eraser case in 3D
Map No. 3: Illustrates assembled with eraser case in 3D
Map No. 4: Illustrates eraser in use with a vacuum cleaner
Map No. 5: Illustrates eraser movement side view
Map No. 6: Illustrates 2nd design version disassembled layout in 3D (part 1)
Map No. 7: Illustrates 2nd design version disassembled layout in 3D (part 2)
Map No. 8: Illustrates 3rd design version disassembled layout in 3D
Map No. 9: Illustrates 4th design version assembled in 3D
Map No. 10: Illustrates 5th design version disassembled layout in 3D
Map No. 11: Illustrates 6th design version disassembled layout in 3D

2. Part description

(10)	Eraser case	(11)	Round shaft hole
(12)	Oblong shaft hole	(13)	Spring holder
(14)	Upper ball seat	(15)	Lower ball seat
(16)	Hose rotator	(17)	Cordless on-off switch
(18)	Guide bar	(19)	Collecting container
(191)	Motor		
(20)	Brusher	(30)	Eraser belt fabric
(40)	Roller	(50)	Roller shaft
(51)	Holding spring	(52)	Screws
(60)	Bracket	(70)	Pad
(80)	Vacuum cleaner	(81)	Vacuum hose

DETAIL DESCRIPTION OF THE INVENTION

Map no. 1 illustrates a new design in the structure of a Dustless eraser for blackboards. This map includes a rectangular hollow eraser case (10) with several round (11), and oblong shaft holes (12), and spring holders (13). The external end of the eraser includes upper (14) and lower (15) ball seats, coupled by screws to hold a ball shaped hose rotator (16).

A brusher (20), with the same dimensions as the eraser case is fastened on the base of the eraser case (10) and remains in continuous contact with the eraser belt fabric (30).

Two rollers (40) are secured to the eraser by inserting two shafts (50) through their centers and then out to the eraser case (10), through round (11) and oblong holes (12).

A hat shaped bracket (60) is fixed to the eraser case by screwing (52) the brackets on both sides to the eraser case (10).

The eraser belt fabric (30) is mounted to the outside of the two rollers (40) and the bracket (60). The eraser belt fabric is supported by the surface of the bracket (60). The vertical sides of the bracket (60) keep the eraser belt in the proper track of the rollers (40).

Two holding springs (52) are hooked to the end of the roller shafts in the oblong holes and to the end of the eraser case (10) into the spring holders (13). These springs (52) will stretch the eraser fabric tightly on the rollers (40) and bracket surface (60).

A pad (70) made of soft material is installed around the edges of the eraser case to avoid any scratches on the surface of the blackboards.

The first step of eraser assembly is to install a brusher (20) firmly on the base of the eraser case and then sleeve the eraser fabric (30) onto the two rollers (40) and support bracket (60). Two shafts (50) are inserted into the center holes of the two rollers (40) and then inserted into the eraser case (10) side round shaft holes (11) and oblong shaft holes (12). The hat shaped bracket (60) is mounted to the eraser case (10) with four screws (52). Two springs (50) connect to the spring holder (13) in the eraser case (10) and the roller shafts in the oblong shaft holes (12). The basic eraser assembly is completed as illustrated on map No. 2. The final step are to mount a soft pad (70) around the edge of the eraser case (10) and put the hose rotator (16) into its case in the upper and lower rotator seats (15)(14) then secure the seats. The assembly of the Dustless eraser is complete, as illustrated in the map. No. 3.

Map 4 illustrates the rotator (16) in the eraser case (10) connected to a vacuum cleaner (80) via a flexible hose (81). Moving the Dustless eraser left or right as a regular eraser on blackboards, the eraser fabric (30) will wipe off chalk powder from the blackboards. Moving the eraser up or down the blackboard will cause the chalk powder inside the eraser to be vacuumed into the vacuum cleaner (80) via the connected flexible hose (81) when the supplied power to the vacuum cleaner has been turned on. A cordless on-off switch (17) to remotely turn on/off the power to the vacuum cleaner can be installed in the back of the eraser case.

Map 5 illustrates the rollers (40) installed inside of the eraser case (10) and a brusher (20) mounted underneath the two rollers. Moving the eraser up and down shifts the exposed eraser fabric (30) to the inner position of the eraser case. At this point, a brusher (20) contacts the eraser belt fabric and quickly wipes off any chalk powder attached to it. Simultaneously, the chalk powder will be vacuumed out of the eraser case and into the vacuum cleaner (80) via the flexible hose (81). When the eraser belt fabric shifts laterally on the rollers (40), the vertical

parts of the support bracket (60) will keep it in place on the rollers (40) track.

Maps 6 and 7 illustrate a 2nd eraser design version. This design has four grooves (11) on the inside surface of the eraser case (10) and act as the eraser holder. The eraser body is a combination of two rollers, roller shafts and bracket. The rollers (40), with their rollers shafts (50), are inserted and supported by two shaft holes on the side of the bracket (60). Then the eraser belt fabric (30) is sleeved onto the eraser body and slid into the grooves of the eraser case (10). The final step is to put a pad (70) around the top of the eraser case and eraser body.

Map 8 illustrates a 3rd eraser design version. This design has the bracket (60) separate from the eraser. When assembling, first sleeve the eraser belt fabric (30) onto the two rollers (40). Then the bracket (60) with shaft holes is mounted to the roller shafts. The assembly is set onto the eraser case and is able to be pushed into the eraser case securely.

Map 9 illustrates a 4th eraser design version. The hose rotator of the eraser case is modified to a funnel shape connector (16). The shape of this connector allows a plastic bag to be connected to it and disposed of after being filled.

Map 10 illustrates a 5th eraser design version. The outlet of the eraser case has two guide bars (18). The collecting container (19) is mounted on the guide bars (18). The collecting container (19) is removable from the guide bars (18) to dispose of the chalk powder in it.

Map 11 illustrates a 6th eraser design version. An additional motor (191) can be installed to the collecting container (19) in the 5th design version. The function of the small motor is to suck chalk powder into the collecting container (19).

In summary, the overall advantage for this newly invention Dustless eraser for blackboards is as follows:

- 1) The eraser case (10) enables a connection to a vacuum cleaner (80) via the hose rotator (10) design. This is the best way to effectively remove chalk powder.
- 2) The brusher (20) on the base of the eraser case (10) has a large surface area in contact with the eraser belt fabric (30). As long as the eraser is moving in an up or down direction, the chalk powder attached to the eraser belt fabric's (30) surface shifted to the base position by the rollers and chalk powder, quickly wiped off by the brusher (20).
- 3) The outline of eraser belt fabric (30) is fully supported by a bracket (60). Since the eraser's belt fabric is in full contact with the blackboards, none of the blackboard's marks will be missed.

- 4) The movement of the eraser belt fabric (30) has been contained inside the bracket (60) when the eraser's belt fabric (30) shifts laterally. This design keeps the eraser's belt fabric in the proper track of the roller.